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(54) Bank note verification device

(57) A device for verifying whether a bank note is genuine includes a support structure 10 on which a bank note is placed, an arcuate guide 11 which ensures that the bank note passes directly between an infrared emitting device 15 and a sensor 26. The sensor is connected by a fibre optic cable 27 to an electronic circuit board 28 which analyses and interprets the transmitted radiation to indicate whether the note is genuine. Switches 18 to 20 are activated according to the denomination of bank note to be tested, and green and red lights 16 and 17 are illuminated to indicate whether the note is genuine.

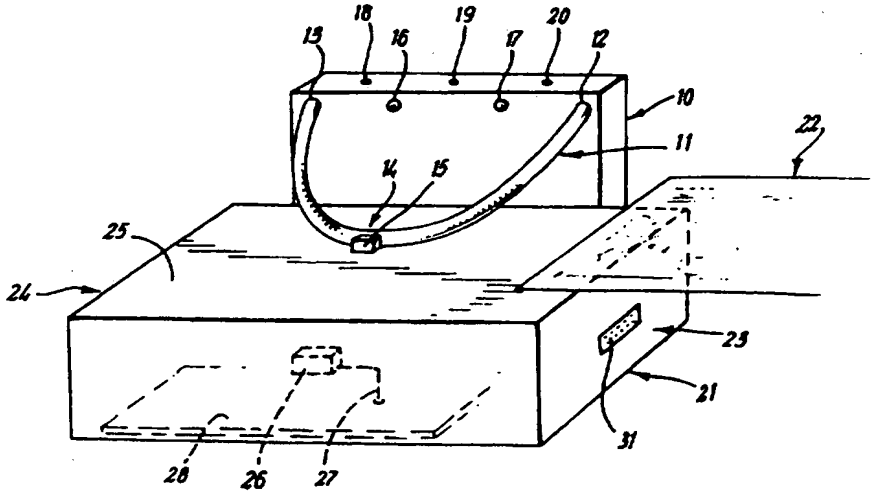

FIG.1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1995

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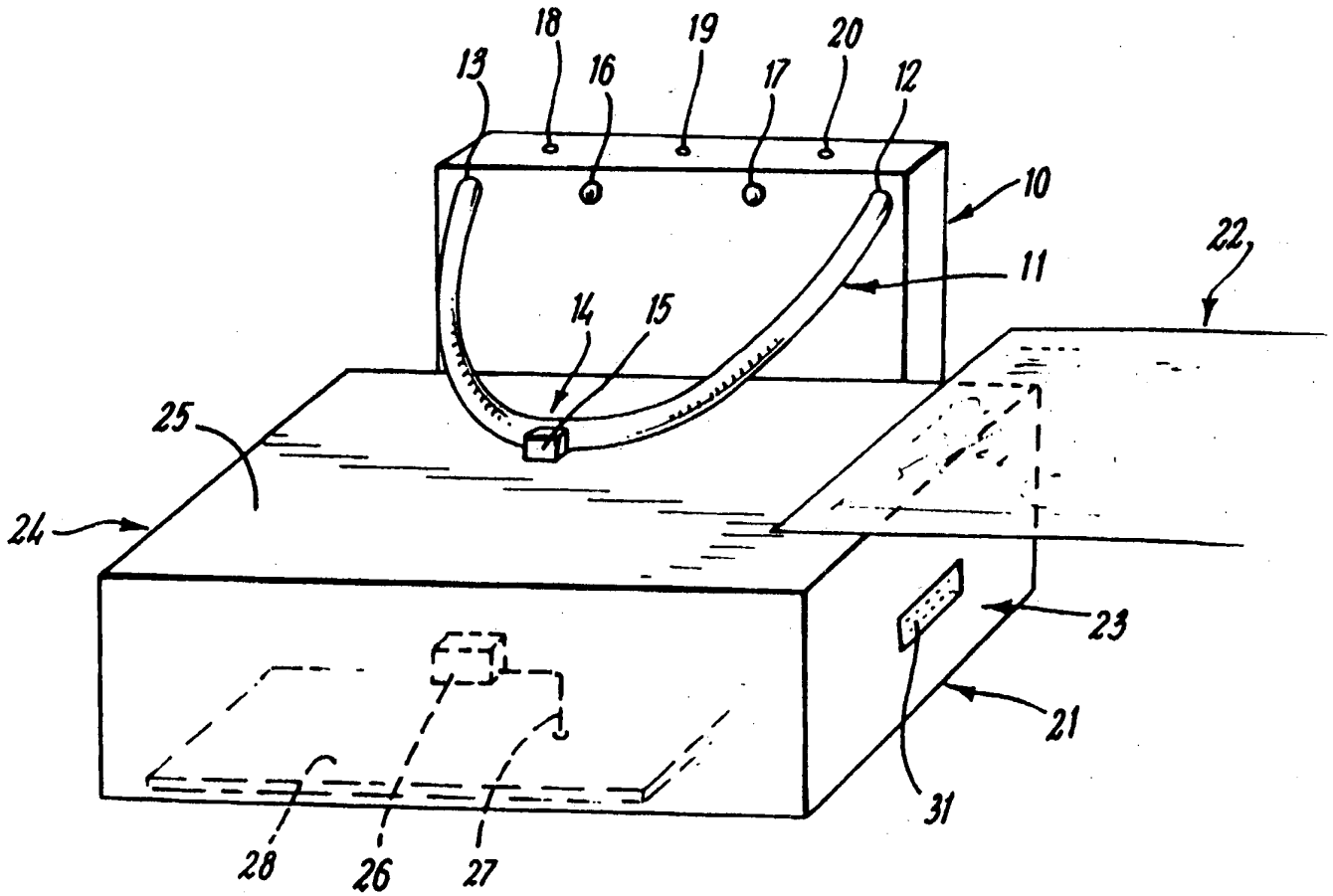

FIG. 1

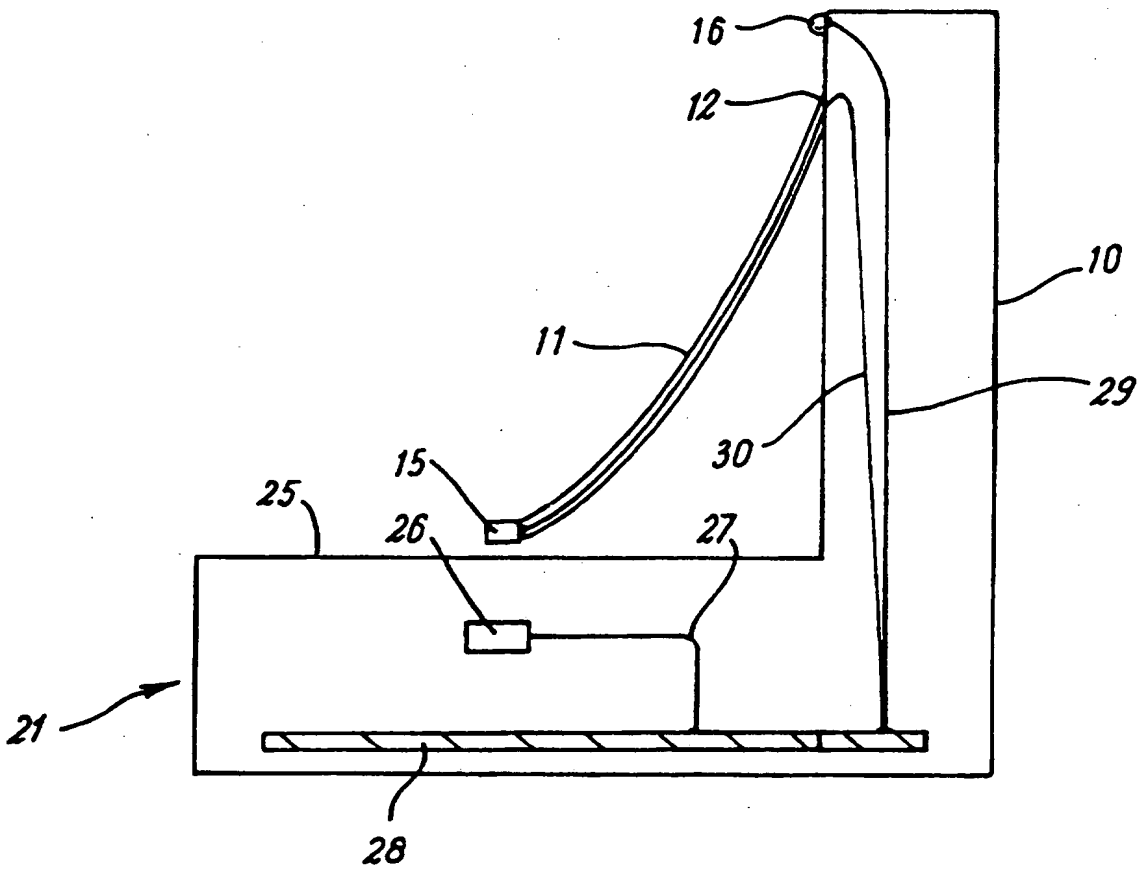

FIG.2

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GENUINE BANK NOTE VERIFICATION DEVICE

The present invention relates to a new and improved bank note verification device.

A bank note verification device appears to have become an essential tool for businesses dealing with bank notes on a regular basis. This is due to the proliferation of forged bank notes which are presently in circulation. There are many different bank note verification devices presently in the market place. However, as forged bank notes become more and more sophisticated the present devices are not able to correctly distinguish between forgeries and genuine bank notes.

Currently, devices utilising ultra-violet light are used to verify whether a bank note is genuine. Under certain circumstances, such a device mistakenly classes a genuine note as a forgery. Certain chemicals in washing powders respond to ultra-violet light. Thus, if a genuine note is washed with such a washing powder, it will respond to ultra-violet light and be classed as a forgery.

Furthermore, certain sunscreen lotions containing ultra-violet blocker components can be used to coat forged bank notes, thus causing problems with the use of a verification device utilising ultra-violet light.

Marker pens have also been used to detect forged bank notes by

detecting certain chemicals which are present in cheap paper and non-genuine ink. These devices are problematic, as notes may be lacquer coated so the chemicals cannot be detected. Furthermore, genuine paper is more easily accessible and is used to produce more sophisticated forged bank notes.

Genuine bank notes are characterised by a distinctive pseudo metal strip along the width of the bank note. Forged bank notes are not usually sophisticated enough to incorporate such a pseudo metal strip. Consequently, devices emitting microwave radiation have been effectively used to detect forged bank notes, as metal is easily detected using a microwave frequency, thus indicating whether a bank note is genuine or a forgery. However, water responds to microwave radiation in a similar manner to a pseudo metallic strip, thus creating an inherent weakness. Furthermore, new and improved forged bank notes which now incorporate a metal or pseudo metallic strip are not detected by such a device.

The main problem associated with existing verification devices is that as new techniques are developed to produce more sophisticated forged bank notes, the existing verification devices become useless.

The present invention is made from a consideration of these problems.

According to the present invention there is provided a bank note verification device comprising at least one source of infra-red radiation, said

device being operative to direct said radiation onto a bank note, at least one sensor to detect the transmitted radiation having passed through the bank note and electronic circuitry to analyse and interpret said transmitted radiation.

Preferably, frequencies in the range of 600-4000cm^{-1} of infra-red radiation are used in the present invention. Preferably, frequencies in the range of 600-1100cm^{-1} of infra-red radiation are used in the present invention. Further preferably, a frequency of 980cm^{-1} of infra-red radiation is used in the present invention.

In a preferred embodiment a single fibre optic cable may be used in the device of the present invention. A fibre optic cable may be used as a pathway to carry the infra-red radiation from its source to the bank note. Another fibre optic cable may be used to carry the transmitted radiation from the sensor to the electronic circuitry.

In a preferred embodiment of the invention, one end of the fibre optic cable may be used as a sensor to detect the transmitted radiation. The end of the fibre optic cable acts as a window and the diameter of the fibre optic cable determines the size of the window. Consequently, the diameter of the fibre optic cable determines the number of separate areas of a bank note that are measured by the verification device. The finer the diameter of the fibre optic cable, the more separate areas of the bank note it will measure. Thus, the diameter of the fibre optic cable determines the number and type of

characteristics which may be identified by the verification device of the present invention. A variety of signals relating to characteristics of a bank note may consequently be identified.

In a preferred embodiment of the invention, the diameter of the fibre optic cable is 0.01 to 5mm. In a further preferred embodiment, the diameter of the fibre optic cable is 0.1 to 1.0mm. In a further preferred embodiment, the fibre optic cable is 0.2 to 0.5mm in diameter. This specific range typically allows 800 separate measurements to be made as a bank note is moved through the verification device.

A bank note has many features which each absorb and emit infra-red radiation in a characteristic way. For example, the paper used in a genuine bank note will transmit a specific frequency of infra-red radiation. Also the amount of this specific transmitted frequency relates directly to the thickness of the bank note paper. Other significant features of a bank note are:- a pseudo metallic strip, black ink on the queens head, a characteristically thin portion of paper. Each of these features will transmit infra-red radiation of a particular frequency and a characteristic amount which can be used to identify a genuine bank note.

Alternatively, data relating to individual features of a bank note can be obtained in composite form. For example a section of printed paper may be analysed, followed by a section of unprinted paper, subtraction of the data

relating to the paper alone means that the resultant data only relates to the ink.

Similarly, data from either edge of the pseudo metallic strip which is centrally located on a bank note can be subtracted from the composite data obtained from the middle of the pseudo metallic strip enabling data relating to the pseudo metallic strip itself to be determined.

The same technique allows accurate determination of the material sandwiched in the centre of two pieces of pseudo metallic strip and in particular, its exact location and therefore pattern within the pseudo metallic strip.

In a further embodiment of the invention, at least one feature of a bank note is identified. Specific signals relating to particular features of a bank note may be stored in the memory of the electronic circuity of the verification device. Consequently, as a bank note is being verified, if it contains all the features as stored in the memory of the verification device it will be identified as genuine.

In a further preferred embodiment of the present invention, the specific features and the number of specific features stored in the memory of the verification device may be altered at any time. Thus, as forged bank notes become more sophisticated the actual characteristics being tested can be varied and the verification device reprogrammed to ensure the more

sophisticated forgery is identified.

Furthermore, in a preferred embodiment of the present invention, the verification device of the present invention may be programmed so that only specific features being identified in a certain order may be classed as being genuine. Thus if a forgery is particularly sophisticated and includes all the major characteristics of a genuine note, i.e., metal strip, water mark, genuine ink, genuine paper etc., it will not be classified as genuine if any of these characteristics are not in the correct order or are displaced slightly from their correct position.

Further to this, the size of the fibre optic cable may be altered so that extremely fine lines can be identified. Some forgeries may be very sophisticated. However, they do not usually incorporate extremely fine lines as in a genuine note. Thus the verification device can verify bank notes on the basis of the size of lines printed on the note.

In a further preferred embodiment of the invention several indicators may be used to indicate whether a bank note being verified is genuine or a forgery. As it is possible for the device of the present invention to distinguish between denominations of bank note and as certain denominations have extra features (e.g., rose and seal on the fifty pound note) indicators may be added to the device of the present invention to comprehensively identify features specific to individual denominations.

In a further preferred embodiment of the invention, a computer data interface may be incorporated into the device of the present invention thus allowing the device to be used to verify all currencies world-wide, thereby allowing it to be used in a foreign exchange bureau.

In a further preferred embodiment of the invention, several emitters of infra-red radiation may be incorporated in a single device. Several sensors positioned so as to detect the transmitted radiation having passed through the bank note may also be incorporated into a single verification device. Thus a plurality of emitters and detectors may be incorporated into the bank note verification device of the present invention.

Furthermore, alternatives to bank notes such as cheques, gift vouchers, certificates, documents, letters of credit and any "plastic" cards may be verified by the device of the present invention with the incorporation of a computer data interface. Characteristic absorption and transmission values of specific features relating to each of these alternatives to bank notes may be stored in the memory of the present device and used to identify whether the item being verified is genuine or a forgery.

In order that the present invention can be more readily understood a specific embodiment thereof will now be described with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of the bank note verification device of the present invention; and

Fig. 2 is a side view of the verification device of Fig. 1.

Referring to Figs. 1 and 2 the verification device comprises a vertically standing support structure 10. An arcuate guide 11 which guides a bank note that is being verified, is attached at both of its ends 12 and 13 to the upper end of the support structure 10. The arcuate guide 11 has an apex 14 at which is placed an infra-red emitting device 15. The arcuate guide 11 houses wires associated with the emitting device 15 along its length.

The support structure 10 also houses indicator lights 16 and 17 at its uppermost section. One of the indicator lights 16 is green and indicates whether all of the genuine features of the bank note are present and in the correct order, thus identifying a genuine bank note. If the combination of features characterising a genuine bank note are not identified or if they are in an incorrect order, the indicator 17 lights up in red, indicating a forgery.

Further switches 18,19 and 20 are incorporated onto the housing structure and relate to the identification of alternative denominations. Thus is a five pound note is being verified switch 18 is activated, whereas switch 19 is required to be activated if a ten pound note is being verified. A fifty pound note requires switch 20 to be activated. Additional switches corresponding to

further denominations may be incorporated.

A box 21, housing electronic circuitry is attached to the lower portion of the support structure 10. A bank note 22 is passed from one longitudinal end 23 to the other end 24 of the box 21 along an upper surface 25 of the box 21 and is guided by the arcuate guide 11 so that the whole length of the bank note passes between the infra-red emitting device 15 and the upper surface 25 of the box 21.

Directly beneath the infra-red emitting device 15, within the box 21 is an infra-red detecting device 26, connected via a fibre optic cable 27 to an electronic circuit board 28.

Wires 29 and 30 attach the electronic circuitry to indicator lights 16,17 and to the emitter device 15 respectively. A socket 31 is housed on one side of the box 21 with which to attach a computer or data interface.

The use of the verification device just described to verify a bank note will now be explained with reference to Figs. 1 and 2.

A bank note 22 is passed from one end 23 of the surface 25 of the box 21 to the other end 24, so that the bank note is directed between the infra-red emitting device 15 and infra-red detecting device 26 along the base surface 25.

The infra-red detector 26 then detects the transmitted radiation from the bank note 22 and passes the information along the fibre optic cable 27 to the electronic circuitry board which analyses and interprets the characteristics of the transmitted radiation to determine whether the combination of specific characteristics relating to a genuine bank note are present and also to determine whether they are present in the correct order and in their precise position. A signal is then passed along wires from the circuitry board to the indicator lights 16 and 17. If the bank note is identified as genuine, the green indicator light 16 is lit and if the bank note is identified as a forgery, red indicator light 17 is lit.

It is noted that the number of bank notes being analysed can be determined easily as the absorption characteristics will be magnified accordingly. The present invention can be used in various other ways, i.e., to count the number of notes present. Further to this the present invention can be used for verification of other paper and plastic financial materials, e.g., cheques, gift vouchers and plastic cards which may have a magnetic strip or microchip.

It is to be understood that the above described embodiment is by way of illustration only. Many variations and modifications are possible.

CLAIMS

1. A bank note verification device comprising at least one source of infra-red radiation, said device being operative to direct said radiation onto a bank note, at least one sensor to detect the transmitted radiation having passed through the bank note and electronic circuitry to analyse and interpret said transmitted radiation.

2. A bank note verification device as claimed in claim 1, characterised in that frequencies in the range of 600-4000cm^{-1} of infra-red radiation are used.

3. A bank note verification device as claimed in claim 1 or claim 2, characterised in that frequencies in the range of 600-1100cm^{-1} of infra-red radiation are used.

4. A bank note verification device as claimed in any preceding claim, characterised in that a frequency of 980cm^{-1} of infra-red radiation is used.

5. A bank note verification device as claimed in any preceding claim, characterised in that a single fibre optic cable is used as a pathway for the infra-red radiation.

6. A bank note verification device as claimed in claim 5, characterised in that a single fibre optic cable is used to carry the infra-red radiation from its source to the bank note.

7. A bank note verification device as claimed in claim 6, characterised in that a single fibre optic cable is used to carry the transmitted radiation from the sensor to the electronic circuitry.

8. A bank note verification device as claimed in any preceding claim, characterised in that one end of a single fibre optic cable is used as a sensor to detect the transmitted radiation.

9. A bank note verification device as claimed in any preceding claim, characterised in that the diameter of the fibre optic cable determines the number of separate areas of a bank note being measured by the verification device.

10. A bank note verification device as claimed in claim 9, characterised in that the diameter of the fibre optic cable is in the range of 0.1-1.0mm.

11. A bank note verification device as claimed in claim 10, characterised in that the diameter of the fibre optic cable is in the range of 0.2-0.5mm in diameter.

12. A bank note verification device as claimed in claim 11, characterised in that at least 800 separate measurements of the bank note are made in verifying the bank note.

13. A bank note verification device as claimed in any preceding claim, characterised in that at least one feature of a bank note is identified wherein the features are chosen from a pseudo metallic strip, ink, thickness of paper or a combination of these.

14. A bank note verification device as claimed in claim 13, characterised in that individual features of a bank note are obtained in composite form.

15. A bank note verification device as claimed in any preceding claim, characterised in that individual features of a bank note are identified in a particular order.

16. A bank note verification device as claimed in any preceding claim, characterised in that fine lines are identified to verify a bank note.

17. A bank note verification device as claimed in any preceding claim characterised in that the device has several emitters of infra-red radiation and/or several sensors to detect the transmitted radiation.

18. A method of verifying a bank note comprising the step of passing a bank note between an emitter of infra-red radiation and a sensor located on the verification device.

19. A bank note verification substantially as hereinbefore described with

reference to the accompanying drawings.

The Patent Office

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Application No: GB 9604877.2 **Examiner:** Bob Clark
Claims searched: 1 and 18 **Date of search:** 20 June 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G1A (AMBP, AMHL)

Int Cl (Ed.6): G07D 7/00

Other: Online database: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2107911 A	(CUBIC) Line 62 page 3 to line 14 page 4	1-4, 3-15 17, 18
X	GB1413335 A	(NATIONALE) Lines 45 to 55 on Page 3	1-3, 18
X	GB1179279 A	(TRANSMARINE) Line75 page 3 to line 34 page 4, and lines 69-86 page 5	1, 16, 18
X	EP0092691 A2	(TOKYO) Line 20 page 4 to line 2 page 9	1, 2, 18
X	US3916194	(NOVAK et al.) line 25 column 4 to line 30 column 5	1-4, 13, 18

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.